NETWORK NEUTRALITY AND PRIVATE SECTOR INVESTMENT

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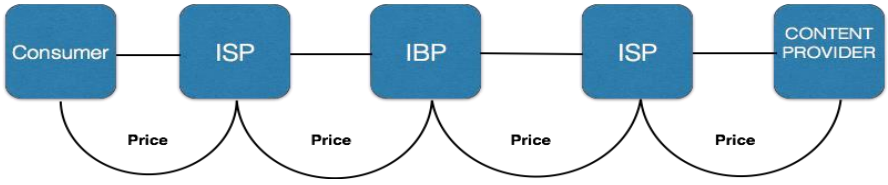
The implications of network neutrality abolition in developing countries are linked to the problems of lack of affordability and access, and might pose important competition problems

Network neutrality and network diversity, a pricing problem

Pricing of Internet connectivity services poses two important regulatory challenges. The first is which pricing model maximizes social welfare and allows achieving the most efficient degree of innovation and investment in two inter-dependent markets, Internet access provision and Internet content supply. The solution might imply the extraction of benefits through price discrimination to content suppliers from Internet access providers in what it is known as the network diversity approach. The second is to discern, whether potential competition problems stemming from vertical integrations in these two related markets—exclusion from access providers to content providers—should be solved with ex-ante regulation, in what it is called the network neutrality approach, or sorted out ex-post by using existing competition legislation. Economic theory approaches these problems with two main types of methodologies, two-sided market models analyzing social welfare by looking at cross externalities between the two markets and models of congestion management analyzing total welfare in a context of bandwidth scarcity. In developing countries where affordability and lack of connectivity prevent the access to the Internet, the network neutrality debate takes a different form and competition problems are distinct. The goal of this paper is to examine network neutrality economic and regulatory implications, to analyze how these implications are related to development goals and suggests policy recommendations.

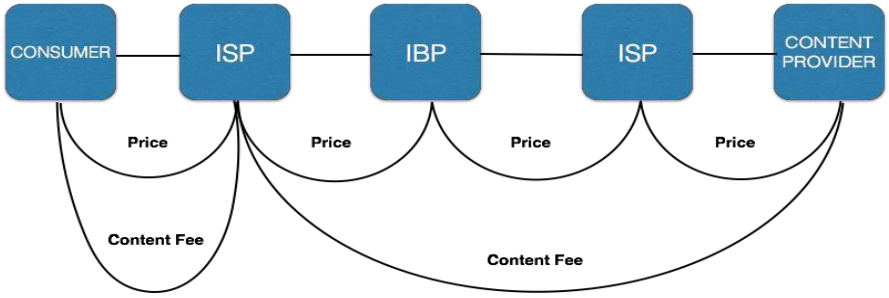
Network neutrality is a regulatory approach to Internet connectivity pricing where customers and content providers (CP) pay a price to their respective local Internet Service Provider (ISP) to access the Internet, ISPs pay Internet Backbone Providers (IBP) an interconnection price to route and transport traffic and net payments between IBP's are normally zero. Under network neutrality all traffic is treated equally and consumer's local ISP does not receive any payment from content providers for the traffic they send through their network; see Figure 1.

Figure 1: Network Neutrality Approach



Network diversity is a pricing model where consumer's ISP charges the content provider a fee that depends on the type of content or application. This is a price discrimination approach that can be implemented in two different ways, by discriminating on quality of service or on amount of data. Price discrimination based on quality entails that delay or throughput sensitive services and applications must pay a fee for guaranteed data delivery, and those content providers not willing to pay the fee would experiment service degradation. Price discrimination based on amount of data is based on charging a higher price to content providers that generate higher amounts of traffic. Additionally, in some variants of the network diversity approach, consumers might also be charged for different qualities of service. Under network diversity, traffic is not treated equally anymore and a different fee is charged to each application or content; see figure 2.

Figure 2: Network Diversity Approach



Whereas content and application providers argue that network neutrality is the cornerstone for an open Internet and has been responsible for the successful emergence of innovative applications such as voice or video over IP, access providers respond that investments to expand network access and deploy next generation technologies are threatened by network neutrality regulations. Extending this logic, the fulfillment of the externalities linked to the use of broadband might be endangered by network neutrality, they argue.

From the perspective of the strategic behavior of access providers, two forces are responsible for their request to abolish the network neutrality principle. Traffic demand is increasing exponentially, congesting fixed and especially mobile networks, due to the emergence of new devices such as tablets, smartphones and other devices, and the increasing usage of multimedia applications, for example Netflix and Google are responsible for about 50% of downstream traffic in fixed networks during peak periods in the US.[1] There is also a shift underway in the balance between the agents in the communications value chain, away from the predominance of access providers towards the increased importance of content providers.

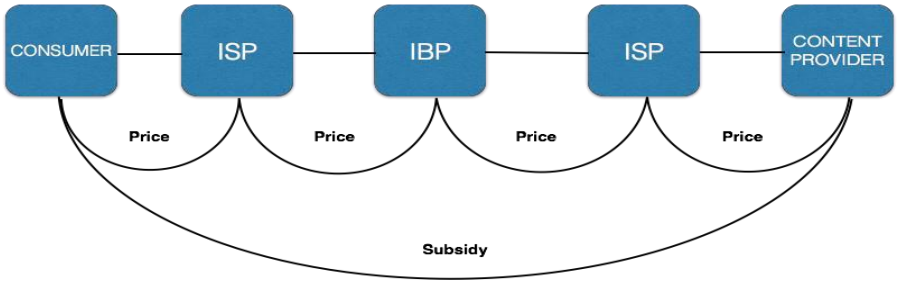
In the developing world where more than half of the population is not online, lack of access and affordability problems are more important than the network neutrality debate as it is conceived in developed countries. When the price of connection is exorbitant it has no sense to discuss if it is convenient to charge

[1] Source: Financial Times http://www.ft.com/intl/cms/s/0/4610dfe8-7dbf-11e3-95dd-00144feabdc0.html#axzz38JGLrSoW

different prices to different services. If there is not access at all, either because broadband is not affordable or because the network is simply not available in that area, how to get users to access is the main problem to solve and network diversity takes a different form.

The new approach to network diversity that has arisen in some developing countries consist of content providers paying users broadband data charges provided that they browse their sites or use their services. Otherwise, users have to pay for the traffic they consume; see Figure 3. Projects such as Facebook Zero or Google free zone offer free mobile access to Facebook and Google services, with sites adapted to existing data speeds. Facebook zero for example is available in 45 countries in Africa and Latin America and 50 mobile operators have signed an agreement with Facebook to implement the model.

Figure 3: Network Diversity in some developing countries



Increased access and affordability, in this case, is at the expense of reduced competition in the access, content provision and publicity over the Internet markets. Regulatory weakness in some developing countries might worsen the problem.

The pricing of Internet services is therefore a competition and a joint innovation and investment problem. The extraction of benefits from content and application providers might boost infrastructure investment and innovation but at the same time, reduce innovation in content generation and innovative services and applications. The key challenge is finding a pricing model with the correct mix of incentives to boost competition in both markets so that the social welfare is maximized. There are also competition problems. Exclusion agreements between Internet access providers and content and application providers, can be solved with ex-ante regulation, and therefore address the problem before it happens—network neutrality regulation—or otherwise, it can be sorted out ex-post by using the existing or additional competition legislation, once the potential damage to effective competition has occurred.

The regulatory implications

ISPs claim for the abolition of network neutrality. They see content providers as agents that generate network congestion, profit from the investments they have made

in network deployment and do not contribute in the development of the platform they use to obtain their benefits. In their view, content providers would be extracting benefits that are necessary to innovate in new access technologies, to invest in network expansion, and to solve congestion problems created by the exponential increases in traffic demand. What ISPs silent however, is that the demand for access provision depends on the demand for content. Without content demand there will not be access demand. The channels by which content providers might extract value from ISPs are mainly two:

First, by depriving access providers from the revenues of its legacy services—telephony, text messages, television etc.—replicating them in the application layer of IP technology without being subject to the regulatory framework that access providers are required to comply with. Examples are telephony and voice over IP, broadcasted television and IP television or SMS and messages over IP. Internet services that are not directly provided by the access provider are called over the top services.

Second, access providers undergo increased congestion in their networks, and are being forced to upgrade infrastructures with fewer revenues due to the extraction of benefits from over the top applications. Whereas extraction is not an anticompetitive behavior in itself, it might pose a problem to social welfare if it prevents the deployment of infrastructures. Some over the top services are generating big amounts of data traffic pressing networks to the capacity limits as with the case of Netflix and Google.

To solve the problem ISP's propose to charge content providers and also users for increased quality of service—a kind of '*Premium Internet*'—and to charge content providers with a termination of interconnection fee (Sending Party Network Pays), in analogy to the regulation of traditional telephone networks.

However, there are reasons to hold the network neutrality approach, in T. Wu and C. Yoo (2006); Wu considers that the economics of infrastructure in the last mile is the key element of the network neutrality discussion. Incumbents in a monopoly position have an incentive to block content and innovative access technologies because it might threaten their business model. Network neutrality would not solve the competition problem in the access network, and abandoning the network neutrality approach would harm the application and content markets in exchange for creating very limited benefits in the last mile infrastructure problem. Network neutrality is an effective method to avoid competition problems, such as traffic blocking and exclusion of competitors. However, whereas this is true in developing countries where the network diversity approach damage competition this might not be so clear in developed countries and more research should be undertaken.

According to Wu, without network neutrality an access provider might prevent the entry of a new innovative application, e.g. VoIP, but expecting increases in innovation and investment in the access network through the abolition of network neutrality is an unrealistic assumption about incumbent behavior. Access providers will have an incentive to distort competition to maintain the current level of scarcity in the last mile. A welfare superior and more plausible solution to solve the problem might be

government intervention, by subsidizing network deployment, or building the infrastructure itself. Examples of this proposal are roads in the US, fixed broadband in many Asian countries or the subsidies offered by Mexico to deploy the mobile access network using the 700 MHz band. Doing nothing waiting for market or technology to overcome the last mile infrastructure problem is also an option, but a risky one since by doing nothing the outcome might be that nothing happens.

Proponents of network diversity however, argue that network neutrality regulation, with the exception of some cases of social production, is unnecessary because the problems that is trying to address or does not exist or can be solved with existing ex-post regulation. Whereas this can be supported in the case of developed countries it can be easily challenged for developing countries.

C. Hemphill (2008) enumerates a set of competition problems that network diversity might pose, and analyzes whether network neutrality is a solution for them. The first, is the case of exclusion accomplished by contract. It occurs when a content provider linked to an access provider agree to exclude or degrade the service of a competing provider. In this case, network neutrality would be unnecessary since antitrust-law already deals with the problem, as the Microsoft-Netscape exclusion case proved. However, Microsoft's example also shows how lengthy the process is and how this can enable the monopolist to keep its market power. Furthermore, the vertical integration problem is already happening in developing countries where content providers pay operators to provide free access to their applications, creating a barrier to the use of other contents as we have seen before.

The second occurs in the event of exclusion accomplished through refusal to deal, e.g. the case of AT&T vs. Vonage, but existing fragmentation of access provision and antitrust prohibitions might solve this competition problem. However, in some cases fragmentation is not enough. There is also an additional problem; the exclusion of social production. This situation occurs when an access provider is able to collect profits from private production but not from social production. In this case the access provider would have an incentive to exclude the social producer, even if social production is more efficient than market production. This is the case of Wikipedia.

Finally, the extraction problem takes place when an access provider charges a content provider for access. In this situation content provider's profit falls and the incentive to innovate and invest in content production is reduced. However, not only content innovation must be taken into account but also infrastructure innovation.

In T. Wu and C. Yoo et al (2006), Yoo considers that in the absence of demonstrated economic effect, practices should not be categorically prohibited. Practices that are sometimes harmful and sometimes beneficial should be subject to the "rule of reason" that entails to analyze case by case to evaluate the potential competitive harm of an action and to allow going forward until a concrete harm to competition has been proved. Regulatory intervention should be limited to prohibit vertically integrated owners from blocking content and applications that compete directly with their own offerings. Yoo maintains that Network neutrality threatens investment and innovation in the last mile networks by preserving high market entry conditions and therefore harming competition. Leaving behind the network neutrality approach

might open competition in the last mile networks allowing for three different kinds of content networks, a network for traditional Internet applications, such as email and Web browsing, a network for e-commerce with security features, and a network for time sensitive applications such as streaming, media and telephony, all of them with a different pricing structure.

The fall in the cost of establishing last mile networks due to the emergence of spectrum-based solutions will change the economics of the last mile infrastructure, making competition feasible and the market contestable. In this new context, promoting competition in the complementary services through network neutrality is no longer the better policy response. The first best policy is promoting competition in the last mile.

Countries position towards the problem is diverse. In some countries such as Chile and the Netherlands the law enforces network neutrality and prevents the use of deep packet inspection, In the US, regulation prohibits the existence of paid prioritization of any kind and bans the existence of fast lanes, but the European Commission revision of the open internet regulation has allowed for a different treatment of specialized services such as IPTV, automated driving or healthcare services provided that these services do not harm the availability and quality of the open Internet Access.

Finally, political manipulation of the Internet and a negative effect on human rights have also been related to network diversity but although it is true that network diversity might facilitate the manipulation of information by making filtering technologies available, information censorship and manipulation and the network neutrality problem are different issues. Censorship happens even with network neutrality regulation, and the same mechanisms to guarantee freedom of opinion that are in operation should prevent censorship with network diversity.

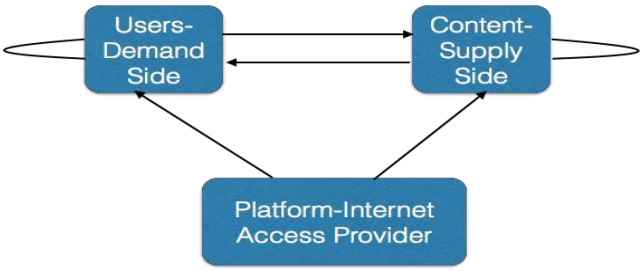
The economics of network neutrality and diversity

Economic analysis uses several methodologies to look into the effects of pricing of connectivity services on total welfare; two are the more prevalent; two sided market and congestion management models.

Two-sided market models consider two groups of agents, the sides, interacting, through a platform. The benefits that each of the agents obtain from joining the platform depend on the size of the group to which the agent belongs, and the other side group's size. The benefits are known as network externalities. There are externalities related to the size of each group and cross-externalities between groups. This means that the more users connect to the Internet the greater is the utility that a user obtains from connecting to the network. The reasons are straightforward, e.g. the greater the number of e-mail users the higher possible destinations for an e-mail. Cross externalities also exist, the more contents are available, the greater is the utility for consumers to connect, and the more consumers, the greater the market for content providers.

In the two-sided market approach, the key parameter to look at is the relative value of the network effects between the two sides of the market; the content-supply side and the consumer-demand side.

Figure 4: Internet two sided market



The determinants of equilibrium prices between agents of a two-sided platform are the magnitude of the cross-group externalities, whether platform fees are flat-rate or payments per amount of traffic, and whether the agents have multi-homing possibilities. Where multi-homing refers to the possibility for a user or content provider to connect to the Internet using different ISPs at the same time, Armstrong (2006).

The social optimum and the number of consumers and content providers that would exist in a market depends on the value of cross-group externalities in both directions, the price that the ISP charge to consumers and the fee that the platform charges to content providers in the network diversity approach, for most values of these parameters, total surplus is higher with network neutrality; N. Economides and J. Tag (2012).

Congestion models are more heterogeneous and analyze bandwidth scarcity to disentangle the effect of internet access pricing on welfare, private investment and innovation.

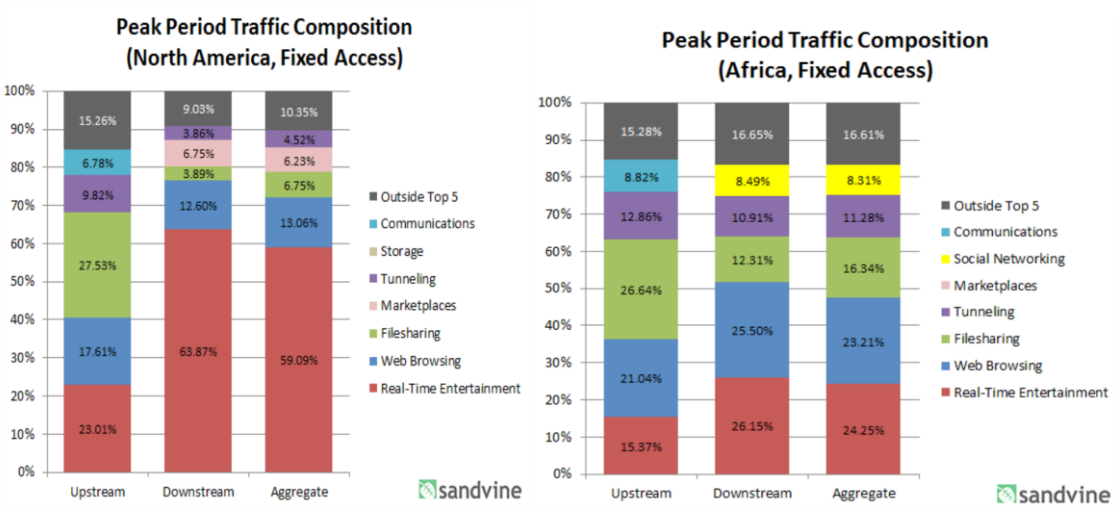
Network diversity can avoid congestion by creating a price for a preferential access to the Internet, but hurt content providers investments; Cheng et al. (2007). Prioritization would make consumers to switch to the content provider that bought prioritization to the ISP, improving productive efficiency but at the same time, consumer utility losses will happen because they would be deprived from the use of some of their preferred services; Choi and Kim (2010). The conditions for network neutrality to be a total welfare superior option compared to network diversity in the presence of congestion, occurs when the elasticity of content demand with respect to transmission time does not increase with households' delay sensitivity for the content; Economides and Hermalin (2012).

The effects of access pricing on social welfare depends on the particular values of the parameters in all models, however, there is no empirical research of the values for most of these parameters. Additionally, any of the models incorporate the externalities of Internet access to the economy as a whole in terms of increased

productivity and employment. Only the externalities between sides in the two-sided market models are considered.

What is the different impact of network diversity in developing countries and in developed economies is still a question that remains unapproached in economic analysis and needs to be studied. An important element in the analysis must be the different patterns of traffic demand in developing and developed countries and the impact of network capacity in shaping demand. For example, whereas in North America the main contributor to traffic demand is streamed audio and video (real time entertainment) with almost 60% share of the total traffic, in Africa, Web browsing is as important as video on demand, and both accounts for around 25% of total traffic; see Figure 5.

Figure 5: Peak traffic composition in North America and Africa



Source: Sanvine Analytics. Available at: https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf

Empirical literature is scarce and diverse from the point of view of the methodology used: R. Clarke (2009) uses a cost model to argue that network costs levels would exceed by an order of magnitude today's levels and therefore neutrality is not be a feasible option. Traffic demand will exceed supply and networks will not be able to satisfy video and other high bandwidth contents with neutrality.

Policy recommendations

Network diversity is not a market demand, and network neutrality in developed countries seems to be a solution for non-existing competition problems. In the case of developing countries network diversity is a trade-off between affordability and competition.

Whereas literature is focused on whether competition problems between access providers and content providers should be solved ex-ante or ex-post, more attention should be given to the value proposition that a differentiated Internet service would

offer to customers. New technological developments suggest that network diversity is not a market demand, since technology has reduced the necessity of differentiated Internet services. Protocols that control congestion at the end point, assume no network support to quality of service, and use packet losses as a signal of congestion to control self-sending rate, reducing network congestion, improving jitter and yielding a fair allocation of network elements. Internet Exchange Points and peering are also reducing the traffic to deliver to the Internet backhaul and backbone, reducing per bit delivery cost, and improving routing efficiency, packet losses and latency. Content delivery networks such as Akamai are also helping to reduce the need of end-to-end solutions. After years of innovation in the effort-less Internet it is maybe too late for access providers to suggest a dedicated path quality of service solution for congestion. The consequence is that network diversity and differentiated services are less necessary to provide low latency and/or low jitter services such as VoIP or video on demand. Only very critical jitter and latency applications such as telemedicine might need a dedicated path and a reserved capacity in each node to succeed.

The existing experience in telephone markets, shows that models where calling network party pays, have not achieved increased competition and investment in the access network, on the contrary, it indicates that incumbents will behave restricting competition in the last mile. Substituting the existing network neutrality, for a calling party network pays approach, might not increase investment in the access network and therefore benefits from departing from network neutrality would not compensate for the losses—innovation in the content and application industries.

However, traffic growth must be monitored, since increased congestion and the subsequent demand for network deployment at a higher pace than in the past might imply a fall in the present value of the gross profits per user that access providers obtain from building and operating the network. This fall would prevent investments in network deployment and as a consequence a social under-provision of broadband. Investments in network upgrades will only be undertaken up to the point that the present value of the necessary costs to satisfying the demand equals the present value of the profits to be obtained. For this reason, increases in traffic demand might make network diversity a social welfare superior option.

Empirical evidence of anticompetitive behavior of access providers is weak in developed countries. Over a decade, the FCC only found four related cases of anticompetitive behavior, suggesting that the ex-post approach to potential competition problems of network diversity might be adequate. However Microsoft-Netscape antitrust case can be seen as an example of how long is the ex-post process and how the delay can allow the monopolist to keep its market power.

In developing countries, however, access and affordability are at the expense of reduced competition in the access, content provision and publicity over the Internet markets. Regulatory weakness in some developing countries might worsen the problem. If a subsidy to consumers is to be allowed, regulatory measures such as the guarantee that all mobile operators are offered the same deal must be adopted.

A subsidy to consumers allows content providers to create a monopoly in related markets to extract monopoly rents. The agreement between Facebook or Google and a mobile operator is an exclusion deal that prevents other content providers to access the market by increasing entry barriers. The agreement also cut down competition in the publicity over the Internet market, since the options for advertising are drastically reduced. Content providers might cross-subsidize developing countries advertisement markets with the developed countries revenues to gain monopoly control of the publicity over the Internet market. Furthermore, if Facebook or Google are not mandated to offer the same agreement to all existing mobile operators, a competition problem in the mobile access market will appear.

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